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Chronic Kidney Disease – Diagnosis and Management

DRAFT for External Review

Access the Guideline and Questionnaire online at:
https://www2.gov.bc.ca/gov/content/health/practitioner-professional-resources/bc-guidelines/external-review

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Scope

This guideline provides recommendations for the investigation, evaluation, and management of adults and youth ≥15 years of age, at risk of/or with known chronic kidney disease (CKD). These recommendations and treatment targets may not be appropriate in all cases because many patients with CKD are complex due to older age and comorbidities.

Key Recommendations

- Identify high-risk patients for evaluation of CKD, including those with diabetes, hypertension, cardiovascular disease, family history, high risk ethnicity (Indigenous peoples, Pacific Islanders, African, Asian, and South Asian descent), and those with a history of acute kidney injury (AKI).
- Screen high-risk patients using estimated Glomerular Filtration Rate (eGFR) and urine Albumin-Creatinine Ratio (uACR). Confirm abnormal test results with a repeat measurement and obtain urinalysis.
- Determine likely cause of kidney disease where possible. This has important implications for determining risk of End Stage Kidney Disease (ESKD)/Kidney Failure and other complications.
- The three dimensions of Cause, eGFR and Albuminuria (CGA) are all important in developing a management plan.
- Control of hypertension, proteinuria, and use of disease modifying drugs can prevent or postpone kidney function decline.
- SGLT2i and ACE-I/ARB are recommended as cornerstone therapy for most patients with CKD.
- SGLT2i, ns-MRA, GLP-1, and ACE-I /ARB are recommended as cornerstone therapy for most patients with diabetes **and** CKD **[NEW, 2025]**.
- Prescribe statins for most patients to reduce cardiovascular risk.
- Obtain prompt advice from local internists, local nephrologists or the RACE to assist in determining the need for and timing of referral.

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Epidemiology

In 2022/23, over 240,000 British Columbians were identified as having CKD (4.1% of the adult population),* which under-represents the expected 10% of adult population.[1] This underscores the need for enhanced education about CKD identification and awareness.

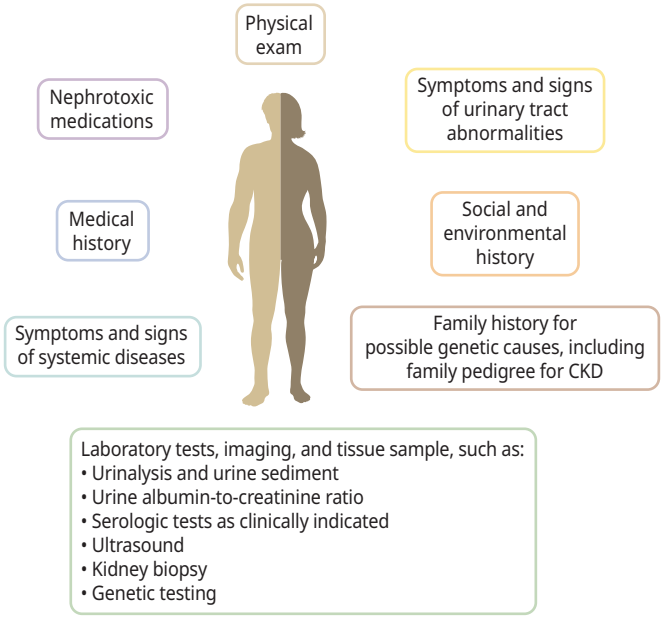
Etiology

CKD is defined as abnormalities of kidney structure or function, present for a minimum of 3 months, with implications for health.[2]

A comprehensive approach is recommended to establish the cause of CKD such as clinical context, personal and family history, social and environmental factors, medications, physical examination, laboratory measures, imaging, and genetic and pathologic diagnoses. See Figure 1: Evaluation of Cause of Chronic kidney Disease.

Figure 1: Evaluation of Cause of Chronic kidney Disease.

Adapted with permission from KDIGO 2024 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease.



The two most common causes of CKD are hypertension and diabetes, which often co-exist.[2,3]

Even if the cause seems obvious (e.g., diabetes), the possibility of other diagnoses, including underlying primary kidney disorder (e.g., glomerulonephritis) should be considered in all patients, and especially those with:

- Abnormal urinalysis, (e.g., proteinuria, hematuria, cellular casts). **Note:** Hyaline casts are normal. See BCGuidelines: Workup of Microscopic Hematuria guideline
- Decline in eGFR >10-15% per year despite correction of reversible precipitants (e.g., volume contraction, febrile illness, medications)
- Constitutional symptoms suggesting systemic illness (e.g., lupus nephritis, heart failure, HIV, liver disease, and dysproteinemias)
- Sudden onset or severe worsening of symptoms (e.g., edema unrelated to heart or liver disease)

* BC Office of the Provincial Health Officer [data provider]. BC Observatory for Population and Public Health [publisher]. Chronic Disease Dashboard. Available at: http://www.bccdc.ca/health-info/disease-system-statistics/chronic-disease-dashboard

The cause of kidney disease (e.g., polycystic kidney disease, glomerulonephritis, diabetes) can affect the rate at which kidney disease worsens.

CKD markedly increases the risk of adverse health outcomes, including cardiovascular mortality, atrial fibrillation, coronary heart disease, stroke, heart failure, peripheral artery disease, acute kidney injury, hospitalization, kidney failure with replacement therapy (dialysis or transplantation).[4] People with CKD are at higher risk of both CVD events and all-cause mortality.[4–6] Most patients with CKD die from other comorbidities before they progress to kidney failure.[2]

Management of hypertension, proteinuria, and use of disease modifying drugs can prevent or postpone kidney function decline.[2] This underlines the importance of early detection, evaluation, changes to health behaviors, and management of individuals with kidney disease.

Risk Factors

The following increase patient risk for developing CKD:

- First degree family history of kidney disease (e.g., parent or sibling)
- Diabetes
- Hypertension
- Cardiovascular disease
- Prior acute kidney injury
- Preeclampsia
- Patients with single kidney
- High-risk ethnic groups: Indigenous peoples, Pacific Islanders, African, Asian, South Asian descent.

Screening

At risk individuals should be considered for screening using blood (eGFR) and urine (ACR) testing every 1-2 years depending upon clinical circumstances (e.g., annually for individuals with diabetes, individuals who have had a cardiovascular event). **Note:** Older age alone is not a reason for screening.

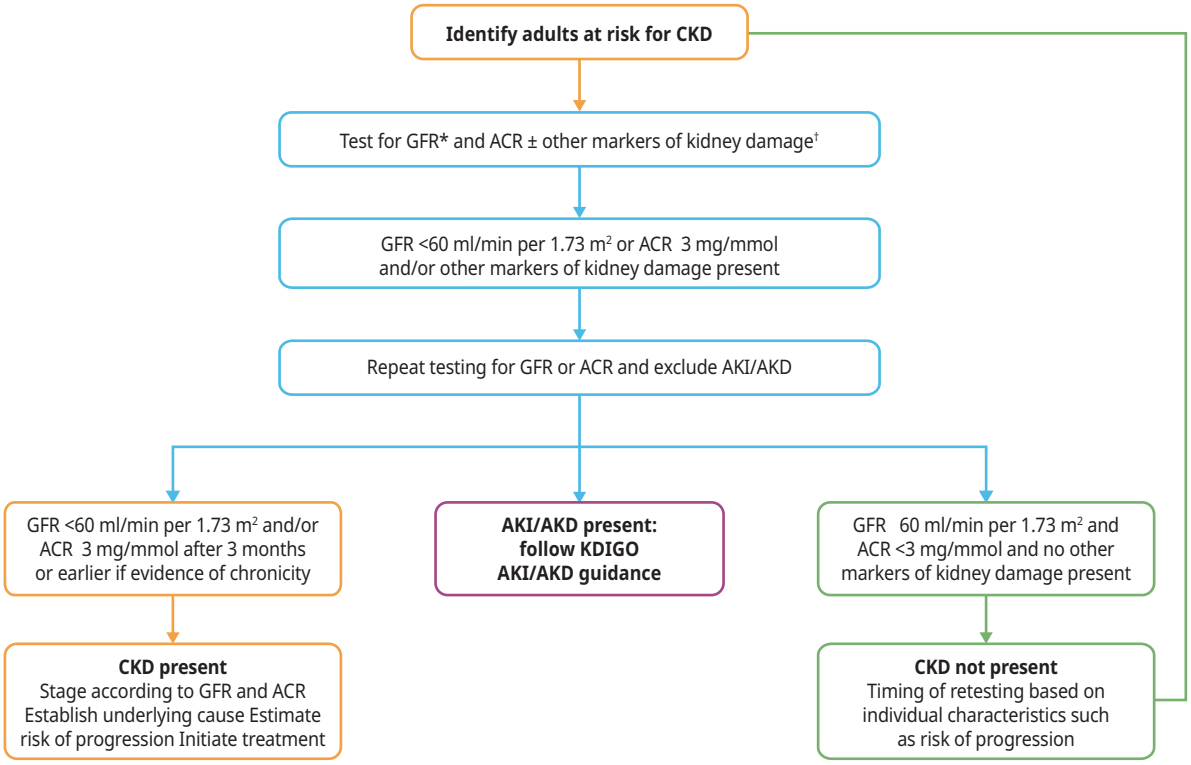
Diagnosis

CKD cannot be diagnosed with **one isolated** abnormal measurement of eGFR or urine ACR, and requires repeat measurements. See Figure 2: Screening Algorithm for Diagnosis and Staging of CKD in adults.

For diagnostic purposes, other evidence of kidney damage may include urine abnormalities (e.g., hematuria), structural abnormalities on imaging studies (e.g., polycystic kidneys) or histological findings on kidney biopsy.

Figure 2: Screening Algorithm for Diagnosis and Staging of CKD in Adults.

Adapted with permission from KDIGO 2024 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease.



ACR - albumin-to-creatinine ratio; CKD - chronic kidney disease; GFR - glomerular filtration rate; AKI - Acute Kidney Injury. *eGFRcr-cys is recommended in certain scenarios. †Markers of kidney damage other than albuminuria may also be used to diagnose CKD, but albumin-to-creatinine ratio (ACR) and GFR are still required to determine stage and estimate risk of progression.

Estimated GFR (eGFR) Values and Interpretation

- Initial values < 60 mL /min per 1.73 m^2 require confirmatory testing.
- In patients with a new unexpected finding of lower eGFR or change in eGFR, the test should be repeated (depending on severity and context, within 1-2 weeks) to establish stability or rapid deterioration.
- Values of < 60 mL/min per 1.73 m^2 which are persistent (present for ≥ 3 months) are diagnostic of CKD.
- Initial values of GFR between 50-60 mL/min per 1.73 m^2 and the absence of other markers of kidney disease (albuminuria, hematuria, structural abnormalities) may not indicate CKD, and need to be contextualized within trends over time of eGFR.

Caveats of eGFR

- eGFR is the common marker for kidney function, calculated from serum biomarkers such as creatinine. eGFR is an estimated value that assumes a steady state of the biomarker.
- In hospitalized patients or patients with AKI, fluctuations in creatinine make eGFR unreliable. In these circumstances, creatinine values and changes in creatinine (not GFR) over time should be used to guide management.
- eGFR may be unreliable in extremes of muscle mass or with certain diets (e.g., very high or very low protein). Some medications can interfere with the excretion of creatinine (e.g., trimethoprim, fenofibrate).[2]
  - Use of an alternative marker (e.g., Cystatin C) may be helpful with extremes of body habitus, spinal cord injuries/muscle wasting, amputations, and the very frail. If uncertain, consider conversation with a Nephrologist or call the RACE.
  - When accuracy of GFR will affect clinical decision-making (e.g. nephrotoxic drugs), using more accurate markers (e.g., eGFRcr-cys) is recommended where the testing is available (See below).
- As a general rule, eGFR can be used to guide outpatient drug dosing even if the references use creatinine clearance (eCrCl). More precision is required for drugs with significant potential toxicity or a narrow therapeutic window (e.g., chemotherapy).

Emerging Use of Cystatin C to Estimate GFR

- Cystatin C is a more recent biomarker of kidney function that is in the process of being used in clinical care. Unlike creatinine, Cystatin C is produced at a relatively consistent rate in most cells and therefore is not impacted by body habitus and/or muscle mass. Cystatin C may be helpful with spinal cord injuries/muscle wasting, amputations, and the very frail.[2] As of the writing of this guideline, Cystatin C is not available in BC. If uncertain, consider conversation with a Nephrologist or call the RACE.

Albumin/ Creatine Ratios (Urine ACR) Values and Interpretation

- uACR is the preferred method to screen for protein in the urine.
  - uACR elevation (> 3.0 mg/mmol) on serial testing (2 elevated results out of 3 tests over a 4-12 week period) is abnormal.
- uACR may be transiently elevated in some patients due to acute illness, vigorous exercise, poorly controlled hypertension or poorly controlled blood glucose. Repeat testing should be done after correcting for the transient factor, using a first morning urine sample, if possible, to ensure a concentrated urine that better reflects the albumin/creatinine ratio.
- See Appendix A: Interpretation of Urine ACR Values to Assess Albuminuria and Proteinuria

Urinalysis (urine microscopy)

- Persistent urine test abnormalities, even with eGFR values ≥ 60 mL /min per 1.73 m^2 suggest kidney disease.
- Significant abnormalities include persistent red blood cells or white blood cells in the absence of infection or instrumentation, and the presence of cellular casts.
- Urine microscopy should be collected at the laboratory as the sample must be analysed within 2-3 hours. See BCGuidelines: Workup of Microscopic Hematuria.
- In most cases, 24-hour urine collections are not necessary to assess protein excretion.
- If laboratory testing of uACR and protein/creatinine ratios is unavailable, dipstick protein measurements can be performed.

Imaging

- Kidney ultrasound should be performed in the following cases:
  - Obstructive urinary symptoms
  - Unexplained microscopic or macroscopic hematuria
  - Unclear etiology of CKD
  - Patients with suspicion of benign prostatic hypertrophy (BPH)
  - Family history of structural kidney disease (e.g., cystic kidney disease)
- Renal ultrasound (kidney and bladder) should be undertaken to assess for structural abnormalities and aid in diagnosis.

Classification and Staging of CKD

CKD is classified as CGA, based on the Cause (C), eGFR category (G1–G5) (G), and Albuminuria category (A1–A3) (A). eGFR is the common marker for kidney function, calculated from serum biomarkers such as creatinine and in some cases Cystatin C. All labs in BC automatically report eGFR when creatinine is ordered. Frequency of eGFR and uACR monitoring is determined by the CGA classification. See Figure 3: Classification of CKD and Frequency of Monitoring.

Staging of kidney disease staging is important for care planning and medical management. Staging is determined based on eGFR and uACR. Patient age, ethnicity, disease cause, current eGFR and proteinuria levels may impact outcomes. Using an externally validated risk equation like the Kidney Failure Risk Equation (KFRE), KPNW, or Z6 score, in people with CKD G3–G5 is recommended. Further details on risk determination are available on the Kidney Disease Improving Global Outcomes (KDIGO) CKD management guideline.

Figure 3: Classification of CKD and Frequency of Monitoring.

Adapted with permission from KDIGO 2024 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease

		CKD is classified based on: • Cause (C) • GFR (G) • Albuminuria (A)		**Albuminuria categories** Description and range		
				A1	A2	A3
				Normal to mildly increased	Moderately increased	Severely increased
				<30 mg/g <3 mg/mmol	30–299 mg/g 3–29 mg/mmol	≥300 mg/g ≥30 mg/mmol
GFR categories (ml/min/1.73 m²) Description and range	**G1**	Normal or high	≥90	Screen 1	Treat 1	Treat 3
	G2	Mildly decreased	60–89	Screen 1	Treat 1	Treat 3
	G3	Mildly to moderately decreased	45–59	Treat 1	Treat 2	Treat 3
	G4	Moderately to severely decreased	30–44	Treat 2	Treat 3	Treat 3
	G5	Severely decreased	15–29	Treat* 3	Treat* 3	Treat 4+
	G6	Kidney failure	<15	Treat 4+	Treat 4+	Treat 4+

Low risk (if no other markers of kidney disease, no CKD)
Moderately increased risk
High risk
Very high risk

A1-A3 and G1-G5 is used to classify CKD. The numbers in the boxes, 1-4 refer to the frequency of lab test monitoring per year.
CKD - chronic kidney disease; eGFR - estimated glomerular filtration rate.

Risk Calculators for Kidney Failure and CV events

The KFRE is designed to estimate probability of requiring dialysis within 2 or 5 years in the absence of interventions. **The risk is modifiable.** The equation is derived from 4 variables and can be calculated using the Kidney Failure Risk Equation. Risks of > 10–20% indicate high risk (analogous to Framingham risk scores). The KFRE is a useful tool for prognostication, and it is recommended for use in routine clinical practice. For cardiovascular risk prediction use of validated tools developed specifically for adults with CKD such as QRISK3, PREVENT that are either developed within CKD populations or that incorporate eGFR and albuminuria is recommended.

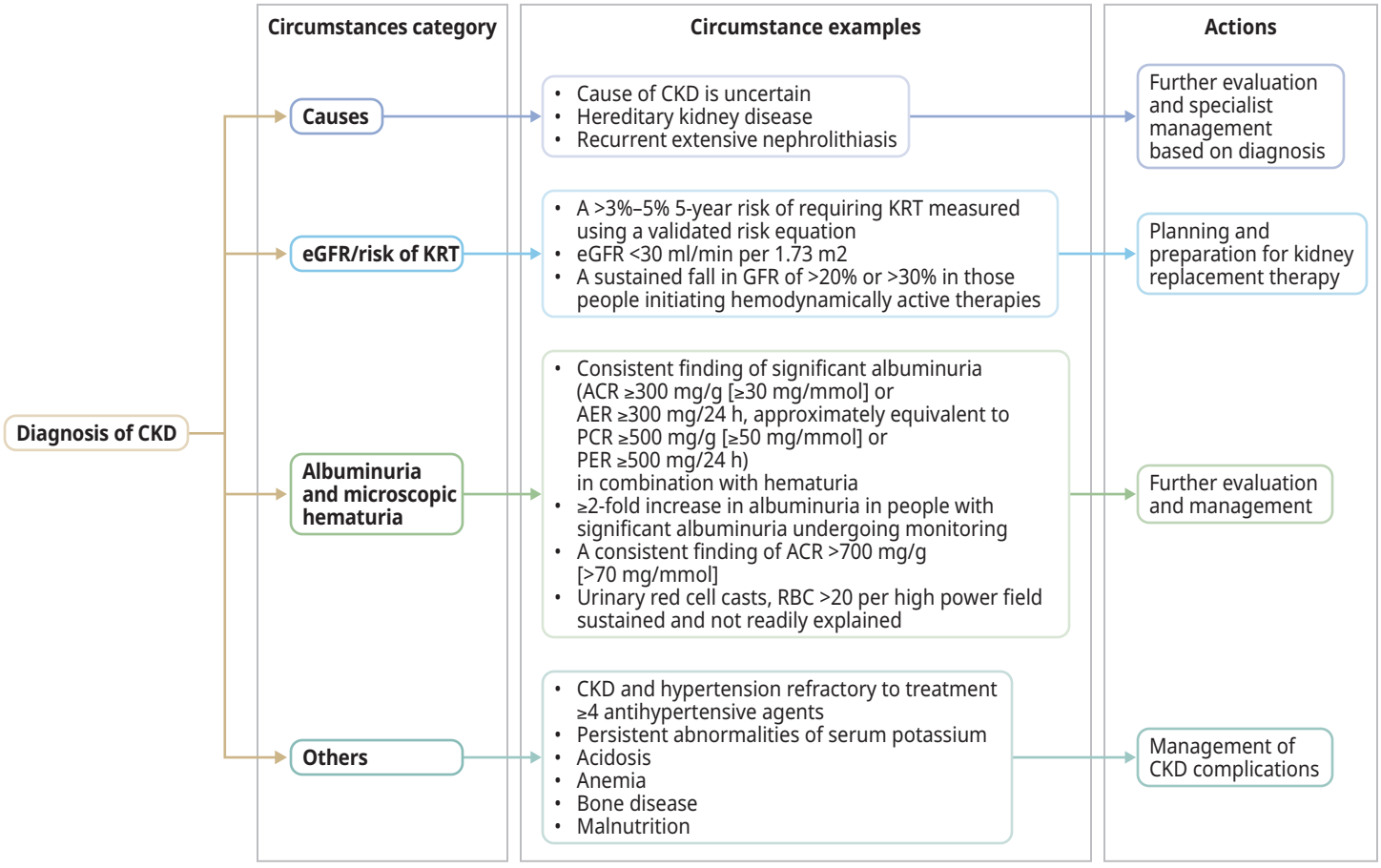
Management

Referral Indications

Many instances of newly identified CKD may be followed and managed in primary care with early specialist collaboration as needed. Conversation with a specialist is encouraged to ensure appropriate management and referral decisions are made in a timely manner. There many be several reasons for referral to specialist services such as establishing cause of CKD, understanding risk of kidney replacement therapy, and chronic albuminuria and microscopic hematuria. See Figure 4: Circumstances for Referral to Specialist Kidney Care Services and Goals of the Referral.

Figure 4: Circumstances for Referral to Specialist Kidney Care Services and Goals of the Referral.

Adapted with permission from KDIGO 2024 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease.



ACR - albumin-to-creatinine ratio; AER - albumin excretion rate; CKD - chronic kidney disease; eGFR - estimated glomerular filtration rate; KRT - kidney replacement therapy; PCR - protein creatinine ratio; PER - protein excretion rate; RBC - red blood cells.

Indications for conversation with/referral to specialist/nephrologist are listed below encouraging earlier collaboration.

Indications for Urgent and Priority Referrals

Urgent Referral Indicated (Urgent concerns should trigger a conversation with the local specialist)

- Presence of active urine sediments (red blood cell casts or cellular casts ± protein), especially when associated with reduced eGFR
- AKI in absence of readily reversible cause (e.g., volume depletion, NSAIDs)
- Abrupt sustained fall in eGFR
- eGFR < 15
- Nephrotic syndrome

Priority Referral Indicated (Patient to be seen within a timely fashion)

- GFR < 30
- Unexplained persistent uACR > 30-70 mg/mmol (regardless of eGFR) e.g., in absence of diabetes or HTN
- Progressive CKD, with eGFR decline > 5 ml/min/year
- Diabetes and evidence of CKD with eGFR < 45, urine ACR > 30

Recommended Referral Package:

- Comorbidities (especially cardiovascular)
- Medications
- Complete blood count (CBC)
- Electrolytes (Na, K, Cl, HCO3), calcium
- Creatinine/eGFR (include current value and any historical values available)
- Urinalysis (urine microscopy)
- Urine ACR
- Kidney ultrasound – not required prior to submitting referral, but recommend it be arranged with result sent to specialist when completed

Referral Resources:

- Use PathwaysBC to see the list of specialists and their wait times.
- Real-time communication with local specialists (or RACE if uncertain) can provide rapid advice for urgent cases and timely phone advice and facilitate the most appropriate mechanism of referral.
- To locate kidney clinics in the region, use the BC Renal website.

A urology consult is more appropriate than nephrology in the following scenarios:

- Kidney mass, gross hematuria, enlarged prostate, obstruction, and large symptomatic or obstructing kidney stone.

Non-pharmacological Management

Patients with CKD require a comprehensive treatment strategy to reduce risks of progression of CKD and its associated complications. It includes both non-pharmacological as well as pharmacological approaches.

Health Behaviours and Self-Management

Support patient self-management with the means available in your community. Promotion of healthy lifestyles can prevent CKD in people at risk and help delay progression in those with CKD.

Patients with CKD benefit from multidisciplinary teams who can support them to make beneficial changes. This may include addressing diet, smoking and physical activity, and understanding of medications. It may also help address the uncertainty and emotional distress. Refer to diet information sheets from BC Renal intended for use by kidney patients in consultation with their renal dietitians. Emerging data suggest an important role of diet, including avoidance of excessive sodium and protein intake, which can cause or worsen glomerular hyperfiltration. A relevant concept that is distinct from primary prevention is so-called primordial prevention, which relates to even more upstream interventions that aim to prevent the emergence of risk factors for CKD.[7]

Pharmacological Management

- Manage co-morbidities that further contribute to patients with CKD. See Table 1: Care Objectives and Targets for CKD.
- First line therapies include sodium-glucose cotransporter-2 inhibitor (SGLT2i) and renin-angiotensin system inhibitors (RASi).[2,8–11]
- Angiotensin-converting enzyme inhibitor (ACE-I) or angiotensin II receptor blocker (ARB) should be first-line therapy for blood pressure (BP) control when albuminuria is present; otherwise dihydropyridine calcium channel blocker (CCB) or diuretic can also be considered.
- See Appendix C: Medications for Chronic Kidney Disease for a list of medications for use in CKD as well as for complications attributable to CKD.
- In those with Diabetes and ongoing proteinuria, non-steroidal mineralocorticoid receptor antagonist (MRA) is recommended.[12,13]
- Targeted therapies are indicated for specific conditions. See Figure 5: Approach to Chronic Kidney Disease Treatment and Risk Modification.

Figure 5: Approach to Chronic Kidney Disease Treatment and Risk Modification.

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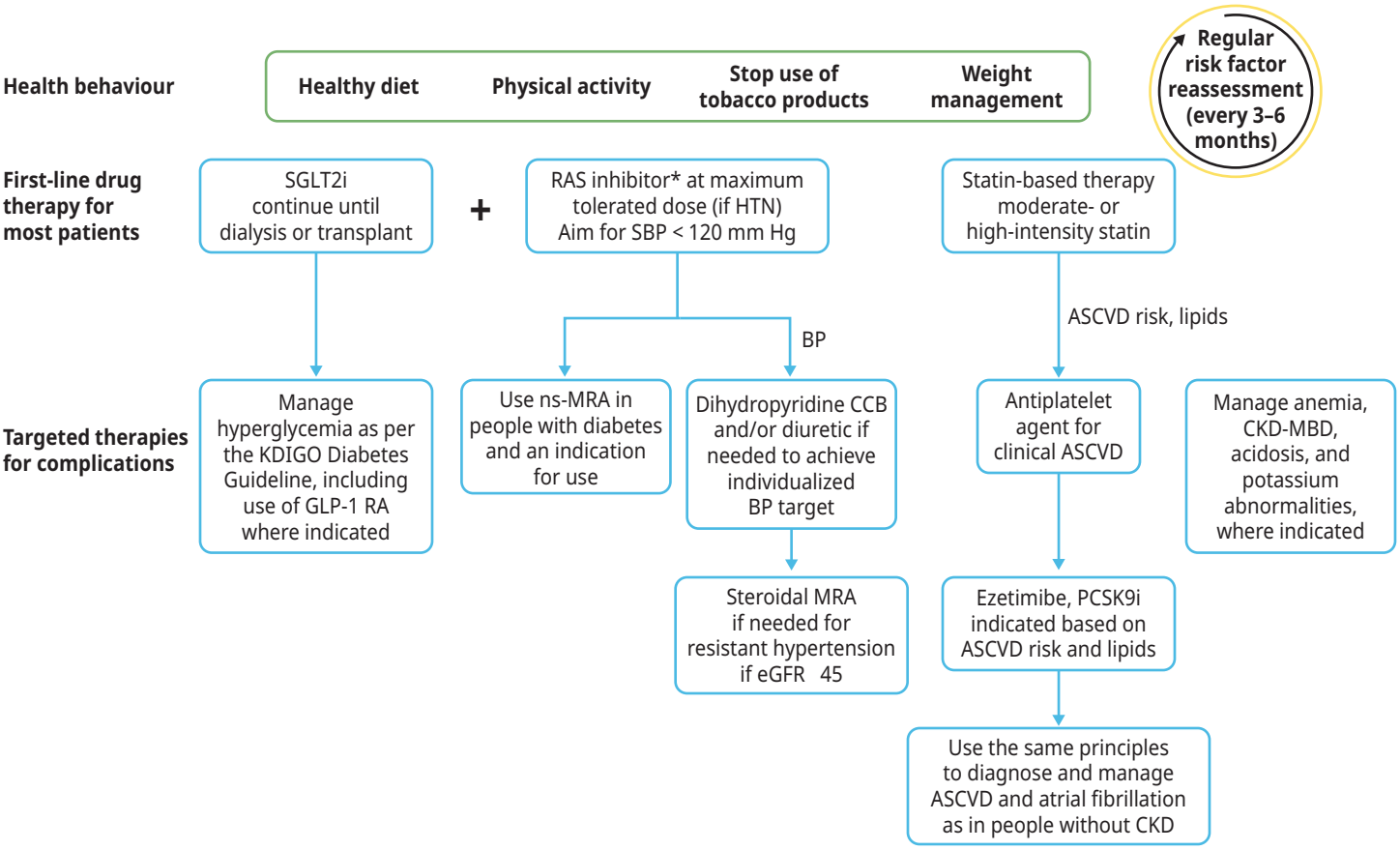

* Angiotensin-converting enzyme inhibitor or angiotensin II receptor blocker should be first-line therapy for blood pressure (BP) control when albuminuria is present; otherwise dihydropyridine calcium channel blocker (CCB) or diuretic can also be considered.

ASCVD - atherosclerotic cardiovascular disease; CKD-MBD - chronic kidney disease-mineral and bone disorder; eGFR - estimated glomerular filtration rate; GLP-1 RA - glucagon-like peptide-1 receptor agonist; HTN - hypertension; KDIGO - Kidney Disease: Improving Global Outcomes; MRA - mineralocorticoid receptor antagonist; ns-MRA, nonsteroidal mineralocorticoid receptor antagonist; PCSK9i - proprotein convertase subtilisin/kexin type 9 inhibitor; RAS - renin-angiotensin system; SBP - systolic blood pressure; SGLT2i - sodium-glucose cotransporter-2 inhibitor.

- Patients with CKD may be more susceptible to the nephrotoxic effects of medications, consider benefits vs potential harms with medications. See Table 1: Care Objectives and Targets for CKD.

Table 1: Care Objectives and Targets for CKD

Domain	Recommendations	Comments
Diabetes	• ACE-I or ARB is generally first line therapy in proteinuric kidney disease • Long-acting sulfonylureas are associated with hypoglycemia and are not recommended • SGLT2is improve glycemic control(if GFR>45) and reduce the risks of CVD and CKD progression in patients with diabetes and chronic kidney disease irrespective of GFR • In those with unstable eGFR or acute changes in clinical condition, metformin should be held, dose-reduced or avoided (see Table in Appendix C: Medications for Chronic Kidney Disease) • Semaglutide at a dose of 1.0 mg once weekly significantly reduces the risk of major kidney disease events[14] • In those with Diabetes and ongoing proteinuria, ns-MRA is recommended.	HbA1C: ≤ 7.0% may not be appropriate for older frail patients Risk/benefit of metformin can be challenging and requires discussion with a specialist, if EGR < 30
Blood pressure	• ACE-I or ARB is generally first line therapy in proteinuric kidney disease • Measure and record BP at diagnosis and at every visit thereafter. See BC Guideline: Hypertension – Diagnosis and Management • Ambulatory BP monitoring is encouraged • Blood pressure targets for CKD vary by guideline however most would recommend a target of < 130/80. • Consultation with a specialist colleague is recommended for complex patients, especially elderly patients with multiple comorbidities.	BP targets are continually changing. Use clinical judgment when interpreting BP targets. Consider comorbidities and prognosis.
Avoidance of acute kidney injury	• Hold ACE-I, ARB, SGLT2i, and diuretics if patient has acute illness with dehydration. • SGLT2i and diuretics should be held if having surgery • If contrast dye (especially arterial) is required, the risk can be mitigated with pre-hydration, please talk to a nephrologist or use a published protocol. Creatinine should be measured pre and post procedure (within 3 days). • The above medications can be restarted safely if there is no evidence of AKI.	AKI is defined as an increase in creatinine by > 26 µmol/L or 1.5 times baseline. Transient insults to the kidney may result in a change in trajectory of stable kidney function. Risk of contrast-induced AKI is higher in people with volume depletion.
Medications	• In CKD, some medications need to be used with caution or dose-adjusted for the level of eGFR • Medication review is critical both during and after an episode of AKI. • If hospitalized or changing serum creatinine, seek additional advice re drug dosing. Refer to BC Renal Agency Pharmacy & Formulary information	Drug interactions are common in CKD and are avoidable
Kidney function measurements	• Refer to Figure 3 for frequency of eGFR and uACR measurements in specific risk categories. • Repeat eGFR sooner (within 10 days) after any change in medications (e.g., ACE-I, ARB, or diuretics), medical intervention, or hospitalization. • Check creatinine and potassium prior to starting ACE-I, ARB, MRA within 7–14 days of starting, and within 7–14 days after a dose increase. • Creatinine rise >20% after dose increase should be followed by further measurements within 7–14 days.	
CVD risk assessment	• Calculate & record CVD risk. Use tools PREVENT and QRISK3 • Manage in accordance with relevant guidelines. • Check lipids once to establish baseline and after therapy x 1. • Consider use of statins and lipid lowering strategies irrespective of LDL levels.	After LDL reduction achieved, regular monitoring of lipids may not be necessary
Vaccinations	• Influenza vaccine annually • COVID vaccines • Pneumococcal and Hepatitis B vaccines recommended for adults at medically high risk. Refer to immunizebc.ca for other recommended vaccines for those with chronic kidney disease	Patients with very advanced CKD are less likely to seroconvert after hepatitis B immunization. Confirmation of immunity is required after vaccination, which may need to be repeated (after consultation with specialist)

Special Populations

Elderly and Frail

Older adults constitute the largest group of persons with advanced CKD. Laboratory results in the elderly and the frail should be interpreted with care to avoid incorrect estimation. Treatment targets should also be adjusted.[2]

Pregnancy and Reproductive Health

Although CKD is associated with decreased fertility, pregnancy is possible at all stages of CKD.[2] People with CKD are at risk for adverse pregnancy-associated outcomes, including progression of their underlying CKD, a flare of their kidney disease, and pregnancy complications including pre-eclampsia, preterm delivery, and small for gestational age infant.[2] Those who have pre-eclampsia are at increased risk for CVD and CKD later in life, and should be assessed for both. All persons with CKD of reproductive age should receive counselling with respect to safe and effective contraception and options/optimization for pregnancy if desired.

Transgender Population

The existing eGFR equations use sex as a binary variable. Therefore, in people who are transgender, gender-diverse, or nonbinary, where a person's gender identity is different from their sex assigned at birth, and/or they are taking gender affirming hormone therapy estimating eGFR may be less accurate (recommend conversation with a nephrologist or a laboratory specialist).[2]

Transition of Care for Pediatric Patients into Adult Care

Coordination with pediatric nephrology to enable transition over a period of 12-18 months minimum is recommended. Starting at 11-14 years of age prepare for transfer to adult-oriented care.

Figure 6: Transition from Pediatric to Adult Care in CKD.

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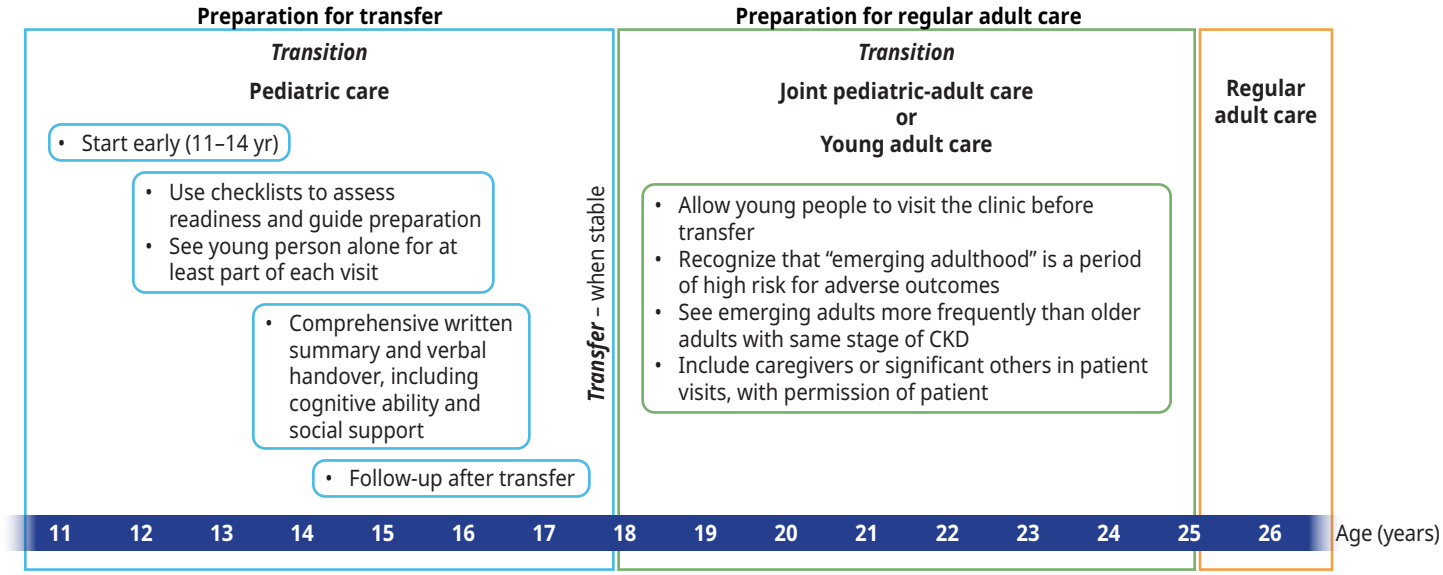

Indigenous Populations

Indigenous people are at higher risk of CKD and may have multiple potential risk factors for CKD, including social, environmental, and biological reasons. Diabetes is common, however a thorough evaluation of all potential causes of CKD is warranted.

Advance Care Planning

Encourage patients with CKD to consider advance care planning and their goals for future care, including for the end of life. Clinicians can find resources to help support difficult discussions such as stopping dialysis treatments, end-stage kidney disease can be found at the BC Renal Agency Palliative Care. Other resources for palliative care can also be found at the Provincial Advance Care Planning and the BC Guidelines on Palliative Care.

Methodology

These guideline recommendations are tailored to support practice in British Columbia and are based on guidance by the Kidney Disease: Improving Global Outcomes (KDIGO). The working group began with the draft of the previous version of the BCGuidelines: Chronic Kidney Disease guideline and studied the recommendations from the KDIGO 2024 Clinical Practice Guideline for the Evaluation and Management of Chronic Kidney Disease to inform this updated version. Where available, key references are provided. In situations where there is a lack of rigorous evidence, the best clinical opinion is provided to support decision making and high-quality patient care. The guideline development process included significant engagement and consultation with primary care providers, specialists and key stakeholders.

Resources

Abbreviations

ACE-	Angiotensin Converting Enzyme Inhibitors
ACR	Albumin-to-Creatinine Ratio
AKI	Acute Kidney Injury
ARB	Angiotensin Receptor Blocker
ASCVD	Atherosclerotic Cardiovascular Disease
BPH	Benign Prostatic Hyperplasia
CGA	Cause, eGFR, and Albuminuria (CKD classification)
CKD	Chronic Kidney Disease
CKD-MBD	Chronic Kidney Disease-Mineral and Bone Disorder
CVD	Cardiovascular Disease
eCrCl	Estimated Creatinine Clearance
eGFR	Estimated Glomerular Filtration Rate
ESRD	End-Stage Renal Disease
GLP-1 RA	Glucagon-like Peptide-1 Receptor Agonist
HTN	Hypertension
KFRE	Kidney Failure Risk Equation
KDIGO	Kidney Disease: Improving Global Outcomes
MRA	Mineralocorticoid Receptor Antagonist
ns-MRA	Nonsteroidal Mineralocorticoid Receptor Antagonist
NSAIDs	Nonsteroidal Anti-inflammatory Drugs
PCSK9i	Proprotein Convertase Subtilisin/Kexin Type 9 Inhibitor
RAS	Renin-Angiotensin System
SBP	Systolic Blood Pressure
SGLT2i	Sodium-Glucose Cotransporter-2 Inhibitors

Practitioner Resources

- **BC Renal:** Clinical resources for physicians, dieticians, pharmacists and information for patients. See bcrenal.ca
- **Rapid Access to Consultative Expertise (RACE):** Rapid Access to Consultative Expertise Program allows Physicians (SPs and FPs), Medical Residents (MRes), Nurse Practitioners (NPs) and Midwives to go to one online application or call one number and speak directly to specialists. See raceconnect.ca/.
- **Real Time Virtual Support (RTVS):** Available to support practitioners in rural, remote, and First Nations communities in BC.
  - Rural Urgent Doctor in aid (RUDi) for instant emergency medicine support.
  - Child Health Advice in Real-Time Electronically (CHARLiE) for instant pediatric support
- **Provincial Laboratory Medicine Services (PLMS):** Accountable for various functions related to the administration of lab services in B.C., and for implementing policies and processes on behalf of the Ministry of Health. To add a test to an existing order, change a test priority or to obtain a test result by phone, see PLMS Contact Us page, call 604-714-2800 or email plmsinfo@phsa.ca.
- **PathwaysBC:** An online resource that allows physicians, nurse practitioners and their office staff to quickly access current and accurate referral information. This includes specialists and specialty clinic wait times and areas of expertise. See: pathwaysbc.ca/login
- **Health Data Coalition:** An online, physician-led data sharing platform that can assist you in assessing your own practice in areas such as chronic disease management or medication prescribing. HDC data can graphically represent patients in your practice with chronic diseases in a clear and simple fashion, allowing for reflection on practice and tracking improvements over time. See: Health Data Coalition – Better Information. Better Care. Better Patient Outcomes. (hdcbc.ca)
- **Family Practice Services Committee**
  - Practice Support Program: Offers focused, accredited training sessions for BC physicians to help them improve practice efficiency and support enhanced patient care.
  - Chronic Disease Management and Complex Care Incentives: Compensates family physicians for the time and skill needed to work with patients with complex conditions or specific chronic diseases.

Patient, Family and Caregiver Resources

- **HealthLinkBC:** Patients can call HealthLinkBC at 8-1-1 toll-free in B.C., or for the deaf and the hard of hearing, call 7-1-1. They will be connected with an English-speaking health-service navigator, who can provide health and health-service information and connect them with a registered dietitian, exercise physiologist, nurse, or pharmacist. See: healthlinkbc.ca/
  - Chronic Kidney Disease | HealthLink BC
- **BC Renal:**
  - Self-Management
  - Diet
  - Sick Day Medication Hold List
- **Advance Care Planning:** Making Future Health Care Decisions. See www2.gov.bc.ca/gov/content/family-social-supports/seniors/health-safety/advance-care-planning

Diagnostic Codes

585 - Chronic Renal Failure

Appendices

- Appendix A: Interpretation of Urine ACR Values to Assess Albuminuria and Proteinuria
- Appendix B: Recommended Drug Modifications in Presence of Acute Kidney Injury (AKI)
- Appendix C: Medications for Chronic Kidney Disease

Associated Documents

The following documents accompany this guideline:

- List of Contributors

References

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Appendix A: Interpretation of Urine ACR Values to Assess Albuminuria and Proteinuria

Categories	uACR (mg/mmol)	Protein reagent strip	PCR (mg/mmol)
Normal to mildly increased	< 3.0	Negative to trace	< 15.0
Moderately increased	3.0 – 30.0	Trace to +	15.0 – 50.0
Severely increased	> 30.0	+ or greater	> 50.0

Appendix B: Recommended Drug Modifications in Presence of CKD and in Acute Kidney Injury (AKI)*

This list is not inclusive and only provides some examples of drugs that require adjustment in CKD and AKI. Primary care practitioners should consult a pharmacist or specialist for more information about specific medication questions.

Medication	Pathophysiology	Recommendation in CKD	Hold in AKI?
NSAIDS (e.g. ibuprofen)	Decreases renal perfusion, interstitial nephritis, analgesic nephropathy	Use with caution in CKD. Consisder alternative (e.g., acetaminophen).	Yes
ACE-I,(e.g., ramipril), ARB (e.g. losarten)	Protective in proteinuric CKD, diabetes, and heart failure but can cause decreased renal perfusion and hyperkalemia	ACE-I or ARB should be held in hypovolemia, and if receiving IV contrast.	Yes
Potassium sparing diuretics (e.g. spironolactone, eplerenone, amiloride)	Volume depletion and hyperkalemia	In CKD (other than in AKI), dose and frequent monitoring is essential if eGFR < 50 mL/min.	Yes
Metformin	Increased risk of metformin associated lactic acidosis (MALA)	Avoid if GFR <30 mL/min	Yes
SGLT2i (e.g. dapagliflozin)	Protective in diabetic nephropathy and cardiovascular disease but can cause decreased renal perfusion in the setting of volume depletion	Hold temporarily in the setting of volume depletion, or prolonged fasting.	Yes
Diuretics (e.g. furosemide and hydrochlorothiazide)	Volume depletion and electrolyte abnormalities	N/A	Yes, unless volume overloaded
Opioids (e.g., hydromorphone, fentanyl, methadone)	Metabolites can accumulate	Reduce dose in CKD For opioids that are considered safer in CKD, and opioids to avoid in CKD, consult: BCRenal - Preferred Medications in Chronic Kidney Disease	Consider dose reduction
Pregabalin and gabapentin	Accumulation	Reduce dose and monitor for adverse effects In severe kidney failure, dose should not exceed 300 mg gabapentin per day.	Consider dose reduction
Digoxin	Hyperkalemia Accumulation with side effects (bradycardia, confusion)	Reduce dose in CKD and monitor potassium and drug levels Consider alternative therapy in the setting of kidney failure.	Adjust dose
Acyclovir/ valacyclovir	Risk of crystal nephropathy Drug accumulation and side effects (risk of seizures/confusion)	Encourage hydration. Dose adjust for GFR	No. Ensure hydration.
Statins (e.g. atorvastatin, rosuvastatin)	Risk of rhabdomyolysis	Consider dose reduction in CKD. Hold if rhabdomyolysis or unexplained/persistent muscle pain.	No
Phenytoin	Risk of accumulation and toxicity	Monitor levels and adjust level for serum albumin	No

Medication	Pathophysiology	Recommendation in CKD	Hold in AKI?
Lithium	Accumulation and increased risk of side effects Risk of nephrogenic diabetes insipidus Risk of chronic interstitial nephritis	Monitor lithium and electrolyte levels. Encourage hydration Refer to a nephrologist if eGFR declines.	No
Hypoglycemics • Sulfonylureas (e.g. glyburide) • Meglitinides (eg. Repaglinide) • Thiazolidinediones (e.g. pioglitazone)	Accumulation can increase risk of hypoglycaemia	Avoid long-acting preparations in moderate-severe CKD. May require dose adjustments.	No
Colchicine	Risk of accumulation and serious toxicity (GI, CNS)	Use lower dose and consider other agents (e.g., corticosteroids)	No
Proton pump inhibitors	Risk of interstitial nephritis and tubulointerstitial nephritis	Clarify indication and consider another agent (e.g., H2 blocker)	No
Warfarin	Glomerular hemorrhage, kidney tubular damage, direct effects on kidney vascular calcification	Monitor INR and adjust dose as needed Consider alternative (e.g., non-vitmain K antagonist oral anticoagulants)	No

For more information on dosing of DOACs in kidney disease please visit the 2018 European Heart Rhythm Association Guidelines (Figure 4).

For more information on common prescribing questions for patients with CKD, consult: Common Prescribing Questions for Patients with Chronic Kidney Disease not on Dialysis.

* Adapted from: *Acute Kidney Injury – potentially problematic drugs and actions to take in primary care*. "Think Kidneys" initiative by the UK Renal Registry in partnership with NHS England.

Appendix C: Medications for Chronic Kidney Disease

Generic Name *Trade name* Dosage form and strengths	Recommended Renoprotective Dose[A]	Approx. Cost per year[D]	PharmaCare Coverage[C]	Adverse Effects[B]	Drug Interactions[B] and Therapeutic Considerations for Chronic Kidney Disease
Drugs for Chronic Kidney Disease					
Sodium-glucose Cotransporter-2 inhibitors (SGLT2i) Examples are listed below. See antihyperglycemic drug table for more info.					
dapagliflozin *Forxiga, G* Tabs: 5, 10 mg	10 mg PO once daily (CKD trial dose)[1]	$270	Regular benefit	• Increased risk of genital mycotic infections; most can be managed with topical antifungal[4] • Canagliflozin: decreased bone mineral density and increased risk of bone fractures • Rare: - Diabetic ketoacidosis - Hypoglycemia (in absence of other hypoglycemics)	• Initiation or use does not necessitate alteration of frequency of CKD monitoring.[5] • Reversible decrease in eGFR on initiation is generally not an indication to discontinue.[5] • Reasonable to continue when the eGFR falls below 20 ml/min per 1.73m^2, unless it is not tolerated or until kidney replacement therapy is initiated.[5] • Withhold during times of prolonged fasting, critical illness, acute management of adverse effects, or 48-72 hours prior to surgery; **have a plan to restart**.[5]
empagliflozin *Jardiance* Tabs: 10, 25 mg	10 mg PO once daily (CKD trial dose)[2]	$1,090	Limited coverage for treatment of type 2 diabetes mellitus (Special Authority)		
canagliflozin *Invokana* Tabs: 100, 300 mg	100 mg PO once daily (CKD trial dose)[3]	$1,140	Non-benefit		

Generic Name *Trade name* Dosage form and strengths	Recommended Renoprotective Dose[A]	Approx. Cost per year[D]	PharmaCare Coverage[C]	Adverse Effects[B]	Drug Interactions[B] and Therapeutic Considerations for Chronic Kidney Disease
Angiotensin Converting Enzyme Inhibitors (ACE-I) Examples listed below. See antihypertensive drug table for more info.					
ramipril *Altace, G* Caps: 1.25, 2.5, 5, 10, 15 mg	**Initial:** 2.5 mg PO once daily **Usual:** 2.5 - 10 mg PO once daily **Max:** 20 mg PO per day	$80	Regular benefit (Reference Drug Program (RDP)) Non-benefit: 15 mg caps	Common • Dry cough (8-12%) • Hyperkalemia Less Common • Angioedema • Precipitation of kidney failure in patients with renovascular disease, volume depletion or concomitant NSAID use	• Use highest approved dose that is tolerated for blood pressure control.[5] • Avoid any combination of ACE-I, ARB, and direct renin inhibitor in people with CKD, with or without diabetes.[5] • Check blood pressure, serum creatinine, and serum potassium within 2-4 weeks after initiation or dose increase.[5] • Hyperkalemia can often be managed by measures to reduce serum potassium levels rather than decreasing or stopping treatment (refer to "Potassium Abnormalities" section below).[5] • Continue unless serum creatinine rises by more than 30% within 4 weeks following initiation of treatment or an increase in dose.[5] • Reasonable to continue even when the eGFR falls below 30ml/min per 1.73m^2.[5] • Consider dose reduction or discontinuation upon either symptomatic hypotension or uncontrolled hyperkalemia despite medical treatment, or to reduce uremic symptoms while treating kidney failure.[5] • Withhold during times of prolonged fasting, critical illness, acute management of adverse effects, or 48-72 hours prior to surgery; **have a plan to restart**.[5]
perindopril *Coversyl, G* Tabs: 2, 4, 8 mg	**Initial:** 4 mg PO once daily **Usual:** 4 - 8 mg PO once daily **Max:** 8 mg PO per day	$100	Partial benefit, RDP		
Angiotensin Receptor Blocker (ARB) Examples listed below. See antihypertensive drug table for more info.					
losartan *Cozaar, G* Tabs: 25, 50, 100 mg	**Initial:** 25-50 mg PO once daily **Usual:** 50 - 100 mg PO once daily (CKD trial dose)[6]	$100	Limited coverage for intolerance to ACE-I	Common: • Hyperkalemia Less Common: • Angioedema • Precipitation of kidney failure in patients with renovascular disease, volume depletion or concomitant NSAID use	
irbesartan *Avapro, G* Tabs: 75, 150, 300 mg	**Initial:** 75 - 150 mg PO once daily **Usual:** 150 - 300 mg PO once daily **Max:** 300 mg PO per day (CKD trial dose)[7]	$90	Limited coverage for intolerance to ACE-I and failure on candesartan, losartan, telmisartan		
HMG-CoA Reductase Inhibitors (Statins) – Moderate or High-Intensity See statins drug table for more info.					
Large trials have shown the following once-daily intensive statin-based regimens are safe in CKD (including people on dialysis):[5] • atorvastatin 20 mg • rosuvastatin 10 mg • simvastatin 20 mg combined with ezetimibe 10 mg					

Generic Name *Trade name* Dosage form and strengths	Recommended Renoprotective Dose[A]	Approx. Cost per year[D]	PharmaCare Coverage[C]	Adverse Effects[B]	Drug Interactions[B] and Therapeutic Considerations for Chronic Kidney Disease
Glucagon-like Peptide-1 Receptor Agonists (GLP-1 RA) Examples listed below. See antihyperglycemic drug table for more info.					
semaglutide *Ozempic* Multi-dose pre-filled pens delivering doses of 0.25, 0.5, 1,2mg	**Initial:** 0.25 mg subcut once weekly x 4 weeks, then increase to 0.5 mg subcut weekly. May increase to 1 mg subcut weekly after additional 4 weeks **Usual:** 0.5 – 1 mg subcut once weekly **Max:** 1 mg subcut once weekly (CKD trial dose)[8]	$3,065	Limited coverage for treatment of type 2 diabetes	Common: • Nausea • Vomiting • Diarrhea • Constipation • Gastroparesis Uncommon: • Pancreatitis • Bowel obstruction • Cholelithiasis	Prioritize using agents that do not require dose adjustment in CKD and have documented cardiovascular, kidney, and mortality benefits:[5] • semaglutide (injectable)* • liraglutide • dulaglutide *Note: Only semaglutide has been studied in a CKD population.[5,8] Benefits of other GLP-1 RA's are extrapolated from trials in people with type 2 diabetes where kidney function was generally preserved.[5]
dulaglutide *Trulicity* Single-use pre-filled pen delivering doses of 0.7, 1.5 mg	**Initial:** 0.75 mg subcut weekly; may increase to 1.5 mg subcut weekly after 1 week Titrate every 4 weeks **Max:** 4.5 mg subcut weekly	$9,830	Non-benefit		
liraglutide *Victoza* Multi-use pre-filled pen delivering doses of 0.6, 1.2, 1.8 mg	**Initial:** 0.6 mg subcut daily for 1 week; then increase to 1.2 mg subcut daily **Max:** 1.8 mg subcut daily	$4,090	Non-benefit		
Diuretics See antihypertensive drug table and heart failure drug table for more info.					
In randomized controlled trials of primary hypertension examining the effect of antihypertensive drugs on cardiovascular outcomes that included participants with CKD, cardiovascular benefits have been most consistent with thiazide-like diuretics (e.g., hydrochlorothiazide, chlorthalidone, etc.).[9] There are no data on clinical outcomes with loop diuretics (e.g., furosemide) in the treatment of high blood pressure with or without CKD.[9]				• Chlorthalidone, indapamide, and metolazone appear to remain effective for blood pressure lowering and/or diuresis at GFRs <30 ml/min per 1.73m^2.[9] • Loop diuretics are effective at lower GFRs (i.e., <30 ml/min per 1.73 m^2).[9] • Withhold during times of prolonged fasting, critical illness, acute management of adverse effects, or 48-72 hours prior to surgery; **must have a plan to restart**.[5]	

Generic Name *Trade name* Dosage form and strengths	Recommended Renoprotective Dose[A]	Approx. Cost per year[D]	PharmaCare Coverage[C]	Adverse Effects[B]	Drug Interactions[B] and Therapeutic Considerations for Chronic Kidney Disease
Nonsteroidal Mineralocorticoid Receptor Antagonists (ns-MRA)					
finerenone *Kerendia* Tabs: 10, 20 mg	10 mg PO once daily if eGFR 25 - 59 ml/min/1.73m^2 20 mg PO once daily if eGFR ≥ 60 ml/min/1.73m^2	$1,285	Limited coverage as an adjunct to standard care therapy in adults with both CKD and type 2 diabetes	Common: • Hyperkalemia (hospitalization for serious hyperkalemia rare)[5] Less common: • Hypotension • Hyponatremia • Anemia	• Contraindications: - Concomitant strong CYP3A1 inhibitors (e.g., itraconazole, ketoconazole, ritonavir, clarithromycin, etc.)[10] - Addison's disease[10] • Initiation not recommended in patients with eGFR < 25 mL/min/1.73m^2 as clinical experience is limited.[5] • Mitigate risk of hyperkalemia by selecting people with consistently normal serum potassium concentration and monitor serum potassium regularly after initiation.[5] • Monitor potassium 1 month after initiation then every 4 weeks.[5] • Hold if potassium >5.5 mmol/l; consider changes to diet or medications to mitigate hyperkalemia; consider reinitiation if / when potassium ≤ 5.0 mmol/l.[5]
Steroidal Mineralocorticoid Receptor Antagonists (MRA) Example listed below. See heart failure drug table for more info.					
spironolactone *Aldactone, G* Tabs: 25, 100 mg	**Initial:** 12.5 mg PO once daily **Target:** 25 – 50 mg daily	$20	Regular benefit	• Hyperkalemia • Dehydration • Nausea • Gynecomastia (usually reversible upon discontinuation)	• Avoid in people with high risk of hyperkalemia (e.g., hypoaldosteronism or type 4 renal tubular acidosis).[9] • Concomitant use with ACE-I or ARB increases risk of hyperkalemia and decline in kidney function, especially among people with eGFR < 45ml/min per 1.73m^2.[9]

Generic Name *Trade name* Dosage form and strengths	Recommended Renoprotective Dose[A]	Approx. Cost per year[D]	PharmaCare Coverage[C]	Adverse Effects[B]	Drug Interactions[B] and Therapeutic Considerations for Chronic Kidney Disease
Treatments for Complications Attributable to Chronic Kidney Disease					
Metabolic Acidosis					
sodium bicarbonate *G* Tabs: 325 mg (3.8 mmol bicarbonate), 500 mg (5.8 mmol bicarbonate), 1000 mg Liquid: 7.5% Injectable: 4.2%, 8.4%	**Initial:** 325–500 mg PO BID or TID. Titrate to achieve bicarbonate level >18 mmol/l and within the expected range. **Max:** 5850 mg/day	$83 (500 mg TID)	Non-benefit	• Bloating, flatulence, increased sodium absorption • Reduced absorption of medications requiring an acidic gastric pH, e.g., atazanavir, calcium carbonate, iron tablets, itraconazole, ketoconazole	• Consider use of pharmacological treatment with or without dietary intervention to prevent development of acidosis with potential clinical implications (e.g., serum bicarbonate <18 mmol/l in adults).[5] • Monitor for fluid retention and heart failure.[12] • Monitor for metabolic acidosis to ensure it does not result in serum bicarbonate concentrations exceeding the upper limit of normal and does not adversely affect BP control, serum potassium, or fluid status.[5] • Avoid serum bicarbonate >32 mmol/L as it is associated with increased mortality in patients with CKD.[12] • Baking soda dissolved in water may be used as an alternative to sodium bicarbonate in patients who cannot take tablets (⅛ teaspoon = 7.1 mmol bicarbonate).[12]
citric acid/ sodium citrate *(Shohl's solution)* *Dicitrate, G* Liquid: 1 mmol bicarbonate/ml	**Initial:** 0.5 mmol/kg/ day in 2–3 divided doses **Target:** Titrate to achieve bicarbonate level >18 mmol/l and within the expected range.	$869 (0.5 mmol/ 70 kg/ day)	Non-benefit		
See oral iron formulations and dosages table for more info.					
Oral iron products • ferrous sulfate • ferrous gluconate • ferrous fumarate • polysaccharide iron • heme iron polypeptide	UpToDate recommends starting with ferrous sulfate 325mg (65 mg elemental iron) to reach either of the following dosing regimens and goals: [11] • Daily dosing goals: elemental iron approx. 200 mg per day in up to three divided doses • Alternate-day dosing goal: elemental iron approx. 65 mg per day in a single dose		Regular benefit: ferrous sulfate, gluconate, fumarate Non-benefit: polysaccharide iron, heme iron polypeptide	• Although ferrous sulfate is commonly available and inexpensive, other oral iron preparations may also be used; there is not significant evidence to suggest that other oral iron formulations are more effective or associated with fewer adverse side effects than ferrous sulfate.[13] • Alternate-day dosing has not been tested in people with CKD. Despite lack of data, it is reasonable to choose this regimen due to potential benefits with regards to iron absorption and side effects.[11]	
Potassium Abnormalities					

Consider potassium exchange agents as a part of second-line therapy to manage serum potassium >5.5 mmol/l in CKD.[5]

1st line: **Address correctable factors**	• Review non-RASi medications (e.g. NSAIDs, trimethoprim) • Assess dietary potassium intake (dietary referral) and consider appropriate moderation of dietary potassium intake
2nd line: **Medications**	Consider: • Appropriate use of diuretics • Optimize serum bicarbonate levels • Licensed potassium exchange agents
3rd line: **Last resort**	• Reduce dose or discontinue RASi/MRA (Discontinuation is associated with increased cardiovascular events. Review and restart RASi or MRA at a later date if patient condition allows.)

Figure 32 | Actions to manage huperkalemia (potassium >5.5 mmol/l) in chronic kidney disease. MRA, mineralocorticoid receptor antagonists; NSAID, nonsteroidal anti-inflammatory drug; RASi, renin-angiotensin system inhibitors.

Abbreviations: **ACE-I** ACE inhibitor; **ARB** angiotensin receptor blockers; **BID** twice a day; **Cap** capsules; **CKD** chronic kidney disease; **CR** controlled release; **G** generics; **IR** immediate release; **IV** intravenous; **ODT** oral dissolving tablet; **LA** long acting; **SR** sustained release; **Tab** tablets; **XR** extended release

[A] Dosages used in CKD trials, if available. Consult product monograph for detailed dosing instructions and dose adjustments for unique patient populations.

[B] Not an exhaustive list. Check the product monograph (https://health-products.canada.ca/dpd-bdpp/index-eng.jsp) or an interaction checker (e.g., Lexicomp(c)) before prescribing

[C] PharmaCare coverage as of October 2024 (subject to revision). Regular Benefit: Eligible for full reimbursement.* Limited Coverage: Requires Special Authority to be eligible for reimbursement.* Reference Drug Program (RDP): may be regular or partial benefit.* Non-benefit: Not eligible for reimbursement. *Reimbursement is subject to the rules of a patient's PharmaCare plan, including any deductibles. In all cases above, coverage is subject to drug price limits set by PharmaCare. See: https://www.gov.bc.ca/pharmacareplans and https://www.gov.bc.ca/pharmacarepolicy for further information.

[D] Drugs costs are average retail cost of the generic, when available. Costs are for maximum dosages where dosage ranges are provided. Current as of October 2024 and does not include retail markups or pharmacy fees.

[E] BC Renal: provides coverage for registered patients who meet criteria. See http://www.bcrenal.ca/health-professionals/clinical-resources/pharmacy-formulary for further information.

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